Abstract:

Methods are disclosed to design resilient hydrofoils (164) which are capable of having substantially similar large scale blade deflections under significantly varying loads. The methods permit the hydrofoil (164) to experience significantly large-scale deflections to a significantly reduced angle of attack under a relatively light load while avoiding excessive degrees of deflection under increased loading conditions. A predetermined compression range on the lee portion of said hydrofoil (164) permits the hydrofoil (164) to deflect to a predetermined reduced angle of attack with significantly low bending resistance. This predetermined compression range is significantly used up during the deflection to the predetermined angle of attack in an amount effective to create a sufficiently large leeward shift in the neutral bending surface with the load bearing portions of the hydrofoil (164) to permit the hydrofoil (164) to experience a significantly large increase in bending resistance as increased loads deflect the hydrofoil (164) beyond the predetermined reduced angle of attack. The shift in the neutral bending surface causes a significant increase in the elongation range required along an attacking portion of the hydrofoil (164) after the predetermined angle of attack is exceed. Methods are also disclosed for designing the hydrofoil (164) so that it has a natural resonant frequency that is sufficiently close the frequency of the reciprocating strokes used to attain propulsion in an amount sufficient to create harmonic wave addition that creates an amplified oscillation in the free end of the reciprocating hydrofoil (164). Methods are also disclosed for focusing energy storage and blade deflections along focused regions of load bearing members and the hydrofoil (164). Methods are also disclosed for reducing induced drag vortex formation along the lee surface of the hydrofoil (164),

reducing drag and increasing the formation of lift forces.

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